

Smoke, Goats, and Oaks: Effects of Goat Browsing and Prescribed Fire on Woodland Structure and Floristic Composition in Ozark Hardwoods

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Overview:

- In eastern U.S. woodlands, targeted browsing, separately and in concert with prescribed fire, holds the potential to meet woodland restoration objectives of increasing the diversity and abundance of ground flora while reducing the density of understory woody stems.
- Targeted browsing had to neutral to positive influence on the coverage of herbaceous species while having minimal impact on nonnative cover. Targeted browsing in combination with prescribed fire significantly increased the coverage of forbs.
- A single targeted browsing event had little impact on tree reproduction density. When combined with prescribed fire, targeted browsing was effective at reducing the density of stems < 1 m tall and > 3.8 cm d.b.h., indicating a fire effect; our results did not suggest that the effects of browse + fire were additive.
- Goats are not picky eaters, and the seasonality of browsing played a minimal role in browse forage preferences. Goats consumed all tree genera although oaks and hickories were least preferred. The one exception observed was that stems less than 10 cm tall were minimally consumed by goats.

Summary:

Management Need: In eastern woodlands, frequent, low-intensity disturbances are needed to achieve desired woodland management objectives: an abundant and diverse ground flora, rich with herbaceous and graminoids species and minimal or isolated-dense patches of woody mid-story cover. These traits are integral to the structure and function of woodland communities. Prescribed burns are commonly used to meet these objectives; however, prescribed fire use can be limited by many constraints (e.g., risk, smoke, limited seasonality, legality), especially at the wildland-urban interface. Targeted goat browsing may have the potential to be used as a supplemental or alternative tool to aid in woodland restoration efforts when prescribed fire is not viable or mechanical mastication is too expensive.

Research Purpose and Design: Our goal was to understand whether targeted goat browsing, a controlled, herbivore-driven disturbance, separately and in conjunction with fire, could be an alternative and effective method of reintroducing disturbances and restoring woodland communities. We investigated goat browse preferences and the effects of treatments on



woody stem densities and plant functional group composition. We tested six treatments: (1) a spring browse (late May), (2) fall browse (late September), (3) dormant bud + fall browse (early April + late September; repeated browse disturbance), (4) a dormant season prescribed fire (February), (5) a spring browse + prescribed fire (late May + February; repeated disturbance), and (6) an untreated control. For each browsing treatment, goats were held in experimental units until approximately 85% of all vegetation was browsed to maintain consistency across treatments, which depending on treatment size, was generally reached within a few days.

Silvicultural Concepts:

- The response of ground flora to treatments was neutral to positive. Broadly, the percent cover of grasses and forbs increased in all browsing treatments. There was significant treatment effect for forb cover in the fire and browse + fire treatments (forb cover increased approximately 9% in both treatments after a single year). This likely indicates that fire has a stronger immediate effect on forbs and repeated browsing disturbance may be needed to mimic this effect.
- Broadly, land managers should expect everything present within their site to be browsed by goats. Trees less than 10 cm tall were not browsed (this can likely be extrapolated to other functional groups less than 10 cm tall). Oaks and hickories will be browsed, but will be qualitatively less browsed (i.e., moderately browsed versus severely browsed) than most other tree species unless goats are not removed.
- Midstory (i.e., stems > 1 m tall and < 3.8 cm d.b.h.) declined significantly in the fire and browse + fire treatments but did not change in the browsing-alone treatment. Goats are not impacting trees enough to cause mortality or the top-killing stems. With repeated browsing disturbance, effects may become more pronounced.

Management Applications:

- In spatial or temporal conditions where prescribed fire is not conducive, targeted goat browsing can aid in reaching woodland management objectives by increasing the abundance of diversity of herbaceous species. In areas where prescribed fire is conducive, targeted goat browsing in concert with prescribed fire may speed restoration efforts by limiting understory woody stem density and recruitment into the midstory.
- Our study utilized a ‘flash graze’ or ‘mob graze’ methodology one to two times during a calendar year. This methodology did not result in significant impact on woody stems. Most impact was directed towards lateral and apical shoots. However, it is likely that repeated browse events during a year or extended over the course several years may have a greater effect on woody stems.



- Compared to a single browse, a single prescribed fire is more effective than browsing at increasing herbaceous cover and reducing the density of woody stems.
- Though are short-term results did not demonstrate that the results of browsing + fire were additive, other research suggests that when applied on the landscape over time, stronger effects may come to light.
- Managers can also use the principles of this research and extrapolate them to live fuel management.





Figure 1—Goat browsing wild plum (*Prunus americana*).



Figure 2—Untreated unit (left) and after the fall targeted goat browsing treatment (right).